

Sub A 5

CLAIMS

1. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall,

wherein ~~it~~ comprises the following steps:

applying on the inner part of a mould a predetermined number of layers of structural fibre fabric incorporated in a plastic material matrix which are to form the inner wall, the outer wall, the two lateral walls and the wings;

arranging an inflatable bag on the layers;

folding a first predetermined number of the layers on the inflatable bag, while a second predetermined number of the layers remain free

applying at least one core over the folded first predetermined number of layers;

folding ~~the~~ ^{the} second predetermined number of the
layers over the core;

applying the outer part of the mould so as to enclose the layers;

inflating the inflatable bag so as to press the layers against the mould:

increasing the temperature of the mould to a

value sufficient to cause reticulation of the plastic material matrix;

removing the bicycle wheel rim from the mould and removing the core, so as to obtain a bicycle wheel rim formed of a single piece of structural fibre material.

2. Method according to claim 1, wherein ~~said~~ ^{the} core applies pressure to said layers.

3. Method according to claim 1, wherein the increase of temperature and application of pressure to the layers occur substantially simultaneously.

4. Method according to claim 1, wherein a cooling phase is provided before removal of the rim from the mould.

5. Method according to claim 1, wherein ~~said~~ ^{the} core is made of a material with a thermal dilation coefficient exceeding 5×10^{-5} mm/ $^{\circ}$ C, the moulding process comprising an increase in temperature to a value sufficient to cause the material of said core to dilate so to press the layers of fabric forming the tyre anchoring wings against the wall of the mould.

6. Method according to claim 5, wherein the material forming the core has a thermal dilation

coefficient exceeding 9×10^{-5} mm/ $^{\circ}$ C.

7. Method according to claim 6, wherein the material forming the core is either PTFE, or PCTFE, or PVDF, or PE-HD.

8. Method according to claim 6, wherein the material forming the core is PTFE.

9. Method according to claim 1, wherein said structural fibres are carbon fibres.

10. Method according to claim 1, wherein said plastic material is a thermosetting plastic material matrix.

11. Method according to claim 1, wherein said temperature is comprised in the range from 80 $^{\circ}$ C to 200 $^{\circ}$ C.

12. Method according to claim 11, wherein said temperature is maintained for a time comprised in the range from 10 minutes to 3 hours.

13. Method according to claim 12, wherein said temperature is maintained for a time comprised in the range from 30 minutes to 3 hours.

14. Method according to claim 1, wherein the core comprises two ring-shaped cores, which are arranged so as to be spaced from each other.

15. Method according to claim 14, wherein each ring-shaped core is made in a single piece of

deformable material.

16. Method according to claim 14, wherein each ring-shaped core is split into several sectors.

17. Method according to claim 14, wherein the space between said ring-shaped cores is filled by a circumferential rib belonging to the mould.

18. Method according to claim 14, wherein a third ring-shaped core, also made of thermally dilating material, is arranged between said two rings.

19. Method according to claim 18, wherein said third ring-shaped core is made in a single piece of deformable material.

20. Method according to claim 18, wherein said third ring-shaped core is split into several sectors.

21. Method according to claim 1, wherein the core is made by a single ring-shaped member of deformable dilating material.

22. Method according to claim 21, wherein the core is made of a silicone sheath.

23. Method according to claim 22, wherein the silicone sheath is divided in sectors.

24. Method according to claim 23, wherein the single ring-shaped core has an outwardly facing recess for engagement of a centering projection of the mould.

25. Method according to claim 24, wherein the centering projection is provided on an outer portion of the mould.

26. Method according to claim 1, wherein the mould comprises two inner circumferential elements arranged side by side, on which the layers for forming the inner peripheral wall and the two lateral walls of the rim are deposited, said mould also comprising an outer circumferential element for pressing said layers (12b) which are to form the tyre anchoring wings over said one or more cores.

27. Method according to claim 1, wherein said structural fibres are selected ^{from a group consisting of} _{among} carbon fibres, glass fibres, aramidic fibres, boron fibres, ceramic fibres, or any combinations thereof.

28. Method according to claim 1, wherein said tyre anchoring wings are firstly made during said

moulding process with a longer length than required and that after opening the mould said wings are reduced to the required length and/or shape by a machining operation.

29. Method according to claim 1, wherein first additional layers (C) are applied to increase the thickness of the outer wall and/or of the two wings of the rim.

30. Method according to claim 29, wherein second additional layers (D) are applied to fill the side regions of the outer wall of the rim from which said wings depart.

31. Method according to claim 1, wherein said mould and said cores are arranged to define a rim with a symmetrical cross-section.

32. Method according to claim 1, wherein said mould and said cores are arranged to define a rim with an asymmetrical cross-section.

33. Method for producing a bicycle wheel rim of the type presenting a peripheral inner wall, an

outer peripheral wall, two lateral walls joining said peripheral walls and two circumferential wings for anchoring a tyre which radially extend outwards from the two sides of the outer peripheral wall, wherein said rim is made as a single part of structural fibre material, by means of a moulding process of several layers of structural fibre fabric incorporated in a plastic material matrix, and wherein said tyre anchoring circumferential rims made in said moulding process are longer than required and wherein after the moulding process said circumferential wings are subjected to a machining operation to reduce them to the required length and/or shape.

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34. Apparatus for the fabrication of a bicycle wheel rim of the type presenting a peripheral inner wall, an outer peripheral wall, two lateral walls joining said peripheral walls and two circumferential wings for anchoring a tyre which radially extend outwards from the two sides of the outer peripheral wall,

wherein it comprises:

- a mould comprising two inner circumferential elements which overlap on a plane, on which

layers of structural fibre fabric incorporated in a plastic material matrix destined to form the inner peripheral wall and the two lateral walls of the rim are arranged,

- an inflatable bag destined to be arranged on the layer destined to form the inner peripheral wall of the rim and to support in turn the layers destined to form the outer peripheral wall and the lateral walls from the inside,
- one or more cores destined to be arranged over said layers destined to form the outer peripheral wall of the rim, made of a material with a thermal dilatation coefficient exceeding 5×10^{-5} mm/ $^{\circ}$ C and
- an outer peripheral mould element destined to press the layers of fabric destined to form said tyre anchoring wings on said cores.

35. Apparatus according to claim 34, wherein it comprises two ring-shaped cores, each split into several sectors, which are arranged so to be reciprocally distanced around the layers destined to form the outer peripheral wall of the rim, each supporting the layers destined to form a respective tyre anchoring wing.

36. Apparatus according to claim 35, wherein the space between said ring-shaped cores is filled by a circumferential rib belonging to the outer peripheral element of the mould.

37. Apparatus according to claim 35, wherein the space between said ring-shaped cores is filled by a third ring-shaped core also made of thermally dilating material.

38. Rim of a bicycle wheel, comprising an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall, wherein said rim is made of a single part of structural fibre based material incorporating the two circumferential wings.

39. Rim according to claim 38, wherein said structural fibres are selected among: carbon fibres, glass fibres, aramidic fibres, boron fibres, ceramic fibres, or any combinations thereof.

40. Rim according to claim 38, wherein it has

a symmetrical cross-section.

41. Rim according to claim 38, wherein it has an asymmetrical cross-section.

42. Rim according to claim 38, wherein it has a layered structure of fibre based fabric material, including at least first layers extending so as to contribute to define the inner wall, the lateral walls and the two wings of the rim and second layers arranged so as to contribute to define the inner, lateral and outer walls of the rim.

43. Rim according to claim 42, wherein the layered structure further includes third layers arranged to define the outer wall and the two wings of the rim.

44. Rim according to claim 43, wherein said layered structure further comprises fourth layers (D) wound in the side regions of the outer walls of the rim from which said wings depart.

45. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an

outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings for anchoring a tyre which radially extend outwards from the two sides of the outer peripheral wall,

wherein the peripheral inner wall, the peripheral outer wall and the two lateral walls are made by applying a number of layers of structural fibre fabric incorporated in a plastic material matrix,

in that said layers are arranged in a mould and an inflatable bag is arranged inside the cavity defined between the layers which are to form said walls, so as to press said layers against the mould wall during the moulding process, and

in that also said circumferential tyre anchoring wings are moulded in the mould by applying a number of layers (12b) of said structural fibre material incorporated in a plastic material matrix, and

in that said layers for making the tyre anchoring wings are applied over one or more cores arranged inside the mould, in the space comprised between the layers (12, 12b) which are for forming the outer peripheral wall and the layers for

forming the two tyre anchoring wings.

46. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall,

^{the inner wall} wherein it comprises the following steps:

applying on the inner part of a mould a predetermined number of layers of structural fibre fabric incorporated in a plastic material matrix which are to form the inner wall, the outer wall, the two lateral walls and the wings;

arranging an inflatable bag on the layers;

folding a first predetermined number of the layers on the inflatable bag,;

applying at least one core over the folded first predetermined number of layers;

folding ^{the} ~~a~~ second predetermined number of the layers over the ~~at least one~~ core;

applying the outer part of the mould so as to enclose the layers;

inflating the inflatable bag so as to press the layers against the mould;

increasing the temperature of the mould to a

value sufficient to cause reticulation of the plastic material matrix;

removing the bicycle wheel rim from the mould and removing the core, so as to obtain a bicycle wheel rim formed of a single piece of structural fibre material, and

wherein also said core applies pressure to said layers.

47. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall,

wherein it comprises the following steps:

applying on the inner part of a mould a predetermined number of layers of structural fibre fabric incorporated in a plastic material matrix which are to form the inner wall, the outer wall, the two lateral walls and the wings;

arranging an inflatable bag on the layers ;

folding a first predetermined number of the layers on the inflatable bag,;

applying at least one core over the folded

first predetermined number of layers;

 folding a second predetermined number of the layers over the core;

 applying the outer part of the mould so as to enclose the layers;

 inflating the inflatable bag so as to press the layers against the mould;

 increasing the temperature of the mould to a value sufficient to cause reticulation of the plastic material matrix;

 removing the bicycle wheel rim from the mould and removing the core, so as to obtain a bicycle wheel rim formed of a single piece of structural fibre material, and

 wherein the core is made by a single ring-shaped member of deformable dilating material.

48. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall, wherein it comprises the following steps:

 applying on the inner part of a mould a

predetermined number of layers of structural fibre fabric incorporated in a plastic material matrix which are to form the inner wall, the outer wall, the two lateral walls and the wings;

arranging an inflatable bag on the layers ;

folding a first predetermined number of the layers on the inflatable bag,;

applying at least one core over the folded first predetermined number of layers;

folding a second predetermined number of the layers over the core;

applying the outer part of the mould so as to enclose the layers;

inflating the inflatable bag so as to press the layers against the mould;

increasing the temperature of the mould to a value sufficient to cause reticulation of the plastic material matrix;

removing the bicycle wheel rim from the mould and removing the core, so as to obtain a bicycle wheel rim formed of a single piece of structural fibre material,

wherein the core is made by a single ring-shaped member of deformable dilating material,

wherein the single ring-shaped core has an

outwardly facing recess for engagement of a centering projection of the mould, and

wherein the centering projection is provided on an outer portion of the mould.

49. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall,

wherein it comprises the following steps:

applying on the inner part of a mould a predetermined number of layers of structural fibre fabric incorporated in a plastic material matrix which are to form the inner wall, the outer wall, the two lateral walls and the wings;

arranging an inflatable bag on the layers ;

folding a first predetermined number of the layers on the inflatable bag,;

applying at least one core over the folded first predetermined number of layers;

folding a second predetermined number of the layers over the core;

applying the outer part of the mould so as to enclose the layers;

inflating the inflatable bag so as to press the layers against the mould;

increasing the temperature of the mould to a value sufficient to cause reticulation of the plastic material matrix;

removing the bicycle wheel rim from the mould and removing the core, so as to obtain a bicycle wheel rim formed of a single piece of structural fibre material, and

wherein said structural fibres are selected among: carbon fibres, glass fibres, aramidic fibres, boron fibres, ceramic fibres, or any combinations thereof.

50. Method for producing a bicycle wheel rim of the type presenting an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls, and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall,

wherein it comprises the following steps:

applying on the inner part of a mould a predetermined number of layers of structural fibre fabric incorporated in a plastic material matrix which are to form the inner wall, the outer wall,

the two lateral walls and the wings;

arranging an inflatable bag on the layers ;

folding a first predetermined number of the layers on the inflatable bag, ;

applying at least one core over the folded first predetermined number of layers;

folding a second predetermined number of the layers over the core;

applying the outer part of the mould so as to enclose the layers;

inflating the inflatable bag so as to press the layers against the mould;

increasing the temperature of the mould to a value sufficient to cause reticulation of the plastic material matrix;

removing the bicycle wheel rim from the mould and removing the core, so as to obtain a bicycle wheel rim formed of a single piece of structural fibre material, and

wherein said tyre anchoring wings are firstly made during said moulding process with a longer length than required and that after opening the mould said wings are reduced to the required length and/or shape by a machining operation.

51. Rim of a bicycle wheel, comprising an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall, wherein said rim is made of a single part of structural fibre based material incorporating the two circumferential wings, and

wherein said structural fibres are selected among: carbon fibres, glass fibres, aramidic fibres, boron fibres, ceramic fibres, or any combinations thereof.

52. Rim of a bicycle wheel, comprising an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall, wherein said rim is made of a single part of structural fibre based material incorporating the two circumferential wings, and

wherein the rim has a layered structure of fibre based fabric material, including at least first layers extending so as to contribute to define the inner wall, the lateral walls and the

two wings of the rim and second layers arranged so as to contribute to define the inner, lateral and outer walls of the rim.

53. Rim of a bicycle wheel, comprising an inner peripheral wall, an outer peripheral wall, two lateral walls joining said peripheral walls and two circumferential wings, for anchoring a tyre, which extend outwards from the two sides of the outer peripheral wall, wherein said rim is made of a single part of structural fibre based material incorporating the two circumferential wings,

wherein the rim has a layered structure of fibre based fabric material, including at least first layers extending so as to contribute to define the inner wall, the lateral walls and the two wings of the rim and second layers arranged so as to contribute to define the inner, lateral and outer walls of the rim, and

wherein the layered structure further includes third layers arranged to define the outer wall and the two wings of the rim.